Form ESA-B4. Final Public Report for ESA-056-3

Company	General Motors	**ESA Dates**	Apr. 8th through Apr. 10th, 2008
Plant	GMPT Bedford	**ESA Type**	Compressed Air
Product	Diecasted engine blocks, transmission casings, and pistons	**ESA Specialist**	Eric Bessey, PE

ESA-056-3, General Motors Corp. – GMPT Bedford

Introduction
The General Motors Powertrain (GMPT) Bedford plant located in Bedford, IN is an aluminum foundry producing engine blocks, pistons, and transmission casings. These products are then delivered to automobiles assembly plants.

Compressed air is an integral and vital part of production. There is a single compressed air system which provides compressed air for the entire plant. Compressed air interruptions can significantly affect production so reliability is paramount. However, General Motors is very energy conscientious and was looking for ways to reduce operating costs while maintaining reliability in their compressed air systems.

Objective of ESA
The objective of this assessment was to identify and quantify energy savings opportunities using the DOE compressed air assessment tool, AIRMaster+.

Focus of Assessment
There is a single compressed air system consisting of five compressors and three air dryers. The compressors are monitored by a PLC/computer system and are operated in a very efficient manner. GMPT Bedford operates the system close to the minimum acceptable pressure. There is ample air storage and compressor part load efficiency is excellent. However, the air compressors are aging and GMPT has an opportunity to install a newer system. This newer system is presently at another General Motors plant which is currently scheduled for closure. Although the newer compressed air system is still in the planning stages, it is hopeful that it can be relocated soon to the GMPT Bedford site. If and when installed, the proposed air compressors will also be controlled by a centralized management system. The system is expected to operate reliably and efficiently in a manner comparable to the existing system. Therefore, the focus of the ESA was not on the supply side but rather the demand side, or how the air is used. Although several energy saving opportunities were investigated, they did not meet General Motor's financial project conditions. This report highlights the compressed air leak opportunity as shown below.

Approach for ESA
The approach for this ESA can be characterized in a series of main tasks, as follows:

- Pre-visit collection of aggregate energy consumption data, system description and system monitoring plan.
- Onsite kickoff meeting including an introduction to the ESA process and logistical review of onsite activities.
- Collection of monitoring data (power and pressure) on each air compressor.
- Technical review and analysis of data, along with data preparation for import into AIRMaster+.
- Determine the baseline airflow profile, then model against the new system using AIRMaster. This determined the proposed baseline energy use for the new system once it is installed.
- System modeling and simulation of energy efficiency measures using AIRMaster+. Savings represented the improvement compared to the baseline new system.
- Review and report of findings.

General Observations of Potential Opportunities
GMPT Bedford purchases electricity from Duke Energy. All energy cost saving figures generated within AIRMaster+ were based upon the 2008 and 2009 anticipated rate structure.

GMPT Bedford operates a single distributed compressed air system. Table 1 provides a list of existing compressed air supply equipment as well as the proposed new compressors.

Observed Compressed Air Supply Equipment						
Equipment	Location and ID	Part-load Control	Main Motor, hp	Aftercooler Type	Rated Capacity, acfm	Rated Pressure, psig
OBSERVED AIR COMPRESSORS						
Joy Turbo Air Centrifugal Compressor, Model TAQ-30R2	Power House	Inlet Guide Vane with Blowoff	700	water cooled	3,000	100
Joy Turbo Air Centrifugal Compressor, Model TAQ-30R2	Power House	Inlet Butterfly Valve with Blowoff	700	water cooled	3,000	100
Joy Turbo Air Centrifugal Compressor, Model TAQ-30R2	Power House	Inlet Guide Vane with Blowoff	700	water cooled	3,000	100
Ingersoll-Rand Two-stage Recip. Compressor, Model PRE-F Series	Power House	5-step Unloading	600	water cooled	2,830	100
Ingersoll-Rand Two-stage Recip. Compressor, Model PRE-F Series	Power House	5-step Unloading	600	water cooled	2,830	100
BASELINE AIR COMPRESSORS TO REPLACE EXISTING *						
(6) Atlas Copco, Oil-Free Rotary Screw Compressors	TBD	Load/Unload	300	air cooled	1,500	100
Total Baseline Compressed Power & Air Capacity			3,300		14,660	

* Note: There will be a total of 6 identical baseline compressors, each 300-hp in size. These compressors will be used instead of the observed compressors during the ESA and are not a part of an energy conservation project.

Table 1. Baseline Equipment

The equipment is in good working order. The power house does an excellent job maintaining the equipment. The power house typically operates on centrifugal compressor as a base loaded unit followed by one or two reciprocating compressors for trim. The compressors are monitored by a PLC and operate very efficiently. Only when the centrifugal operates in blowoff (low demand periods) does the system operate inefficiently. This happens only for brief periods and is of little significance. Air is efficiently dried by three cycling refrigerated dryers. Several no-air loss drains are installed to handle condensate. There are several air receivers throughout the plant, which combined with the distribution piping, provides ample air storage. There is very little to be done on the supply side to improve efficiency.

Though the air compressors are well maintained, the equipment is aging. The reciprocating compressors are nearly 50 years old and the centrifugal compressors are approximately 25 years of age. GMPT Bedford has the opportunity to install a system from another General Motors plant which is expected to close. The proposed compressed air system utilizes efficient load/unload controls with a centralized management system. Air will be dried using efficient heat-of-compression air dryers. This new system is expected to operate at an efficiency comparable to the existing system, and is considered the baseline from which improvements are modeled against. AIRMaster was used to simulate the energy baseline for the new system.

There are several uses of compressed air. These include but are not limited to:

- air nozzles on diecasting machines
- air motors to stir molten aluminum
- liquid stirring motors
- fire suppression system

- air operated diaphragm pumps to transfer diecaster lubricant
- pneumatic bladder valves
- electronic cabinet coolers
- bag house element cleaning (pulse air)
- nitrogen generation
- air valves and cylinders
- general instrument air
- Waste Water treatment system-Control valves and stirring of water

The system is maintained at approximately 85-90 psig during production. During down days, the compressed air system is reduced to 80 psig. This is to keep the fire suppression system pressurized and supply air to the tool room and water treatment plant. When the plant including the tool room is shut down, the system pressure could be lowered to 60 psig.

All compressors were monitored. Baseline flow, power, and pressure profiles were developed. The combined annual existing compressed air baseline energy was **7,312,706 kWh**. The baseline airflow profile was then modeled against the new air compressors to determine the adjusted baseline. The adjusted baseline energy was **7,077,527 kWh.** The adjusted baseline was used to calculate savings. Although five (5) EEMs (Energy Efficiency Measures) were initially identified and evaluated using AIRMaster+ compressed air system analysis software, only 1 met GM's project implementation criteria. The EEMs that were initially evaluated are as follows:

- Install Electric Pumps for Diecaster Mold Lube
- Replace Pneumatic-driven Stirrer Motor with Electric Motor on #18 Furnace
- Improve Diecaster Mold Blowoff
- Shut off Main System on Down Days
- Reduce Air Leaks.

Table 2 provides a Savings Summary. Savings for the reduction of air leaks represent an improvement over the baseline.
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SAVINGS SUMMARY FOR GENERAL MOTORS - GMPT BEDFORD		
EEM Description	Energy Savings	Energy Savings in Percent
Reduce Air Leaks	1,144,894	16.20%
Totals	1,144,894	16.20%

Table 2. Savings Summary

Descriptions of EEMs
The following EEM was discussed with the staff at GMPT Bedford. GMPT Bedford is interested in EEMs which yield a payback of one year or less.

EEM 1 – Reduce Air Leaks – Near Term Opportunity
There are numerous leaks in the plant. Although the DOE assessor initially determined (by flow metering) that the plant had a leak load of approximately 1,800 acfm, he did not account for the various compressor air loads that were being used by process equipment. Accounting for the compressed air process loads, a more realistic leak load for this facility is between 1200 and 1500 acfm. . While completely understandable and not unlike plants of this type, this is an enormous load. Great effort should be spent toward fixing air leaks. A quarterly leak detection and repair program should be

considered. GMPT Bedford should also consider valving off areas when not in use. This would save the leak load to unused areas.

Not all air leaks can be fixed and more will develop over time. This is why a regularly schedules leak repair plan is necessary to sustain savings.

Maintenance Opportunities
As previously stated GMPT Bedford's maintenance staff does an excellent of maintaining equipment in good working order. No significant opportunities for improvement were noted.

Management and UAW Support and Comments:
A corporate level management team and the UAW/WFG Joint Task Team encourage any effort that reduces energy consumption at General Motors Facilities. The Joint Task Team has developed several Best Practices that encourage use of the DOE Energy Saving Assessment Tools. There is an Energy Engineer with this assignment at each facility.

The UAW/WFG Joint Task Teams have identified several Department of Energy (DOE) best practices that will have a significant impact if implemented at GM Facilities. Due to the focus of the Best Practices there is an opportunity for our UAW Skilled Trades to provide a substantial cost savings impact to the operating costs of our facilities by working jointly with the GM/WFG management organization.

UAW/WFG Joint Task Team, DOE associated Best Practices:
BMES-01 Pumping System Assessment Tool
BMES-02 Air Master + Diagnostic Tool
BMES-03 Motor Master + Diagnostic Tool
BMES-04 Steam System Assessment Tool
BMES-07 Fan system Assessment Tool
BMES-09 Chilled Water System Assessment Tool

The UAW Skilled Trades working in conjunction with the GM/WFG Energy & Utilities Services Group (EUSG) and the GM/WFG Facilities Management Group (FM) can jointly pursue the effort to optimize the operating efficiencies of these major systems that are found in GM facilities.

The DOE has allowed a minimum, of (20) no cost joint assessments at GM facilities for calendar year 2008. A Joint effort will help to achieve the best possible results and should have a direct impact on cost savings potential.

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